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AUTHOR McGee, Glenn W.
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ABSTRACT

Although technological innovations have been widely adopted in elementary schools, efforts to implement them have been generally unsuccessful. Past research indicates that the principal's endorsement, sustained support, and ability to overcome resistance to the innovation are necessary for effective implementation. The nature of this support, however, remains vague. Using data collected from teachers, principals, and media center directors in a random sample of 130 elementary schools, this study examines the nature and effect of principals' use of three types of support: economic incentives, political incentives, and moral support and encouragement for microcomputer implementation. The study also examines how the principal's support role varies in schools of high, low, and average socioeconomic status. Findings indicate that moral support is not related to implementation, but that the use of both economic and political incentives (especially recognition from school boards and superintendents) is effective in high status schools. Results for low and average status schools are mixed. This study shows that future implementation research cannot ignore social context. Included are 4 tables, 2 figures, and 23 references. (MLH)

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The Effectiveness of Incentives on the Implementation of a Technological Innovation

Glenn W. McGee

University of Chicago

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AERA Presentation

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The Effectiveness of Incentives on the Implementation of a Technological Innovation

Abstract

Although technological innovations have been widely adopted in elementary schools, efforts to implement these have generally not been successful. Past research on innovation suggests that the principal's "support" is crucial for implementation, yet the literature does not specifically define this term. Using data collected from teachers, principals, and media center directors in a random sample of 130 elementary schools, the author examines how the nature and effectiveness of the principal's use of incentives and support for the implementation of microcomputers varies in schools of low, average, and high socio-economic status (SES). The findings indicate that support is not related to implementation but that the use of incentives is an effective means of promoting implementation in high SES schools.

Problem Statement

In the last two decades technology has become commonplace in elementary schools. Few schools exist which do not contain at least a few pieces of equipment such as a television, film projector, reading machine, video cassette recorder, or most recently, a microcomputer. In many, if not most, schools, however, technological innovations are not an integral part of the curriculum (Lipson, 1981). After their adoption and perhaps an initial flurry of use, they have yet to be implemented into the regular curriculum (Pincus, 1974). Notes Sarane Boocock (1980): "During the 1960s a number of technological innovations were introduced in American classrooms . . . it is interesting to note that by the early 1970s most of these innovations had disappeared or changed almost beyond recognition" (p. 174).

The 1980s have brought more innovations but with no more successful implementation than found in the two previous decades. The ubiquitous microcomputer is the most recent and widespread example. School boards, administrators, teachers and parent groups have rushed to obtain inexpensive microcomputers for their schools (Winnipeg, 1983). Once the machines are placed in the schools, however, they frequently receive only minimal use (Becker, 1982).

When innovations do succeed, though, partial credit goes to the principal of the school. The literature suggests that the principal's endorsement, sustained support, and ability to overcome resistance to the innovation are necessary for successful implementation (Gross, et al., 1971; Crowther, 1972; Berman and McLaughlin, 1978; Miles, 1978; Runkel, Arends, Arends, and Francisco, 1979; Reinhard, Arends, Burns, Kutz, and Wyant, 1980; Rutherford, 1981). The nature of the principal's "support", however, remains vague. Not one of the studies specifies exactly what the principal does to provide leadership for implementing innovations. One purpose of this study, then, is to examine the role of the principal in providing three types of support: economic incentives, political incentives, and moral support and encouragement.

A second purpose of this paper is to examine how the effectiveness of the principal's role in providing incentives differs in schools of high, low, and average socio-economic status (SES). Recent research by Becker (1983) and McGee (1985) indicates that school SES influences how extensively and for what purposes computers are used. Coupled with Hallinger and Murphy's (1985) study which shows

that the actions of effective principals vary according to SES, these studies indicate the importance of examining the interaction among incentives and SES.

Although this study concerns the implementation of one technological innovation, the microcomputer, the author hopes that by understanding the principal's role in providing incentives and support for this one innovation, one will gain a more thorough understanding of the interrelationship of the nature and use of principal's "support," SES, and successful implementation of technological innovations.

Theoretical Framework and Selection of Variables

The independent variables chosen for this study were "moral support and encouragement," "economic incentives," "political incentives," and SES. The first variable describes the principal's role in promoting the use of the innovation. Actions falling into this category include:

1. Encouraging teachers individually or in staff meetings to use the computer
2. Giving verbal "pats on the back"
3. Writing informal congratulatory notes
4. Listening to problems

5. Helping solve problems
6. Directly assisting in the classroom
7. Using charisma
8. Appealing to teachers' institutional or professional loyalty

These supportive behaviors have been culled from several studies of innovation (Gross, et al., 1971; Crowther, 1972; Kritek, 1976; Berman and McLaughlin, 1978; Miles, 1978; Runkel, Arends, Arends, and Francisco, 1979; Reinhard, Arends, Burns, Kutz, and Wyant, 1980; Rutherford, 1981).

The second variable, "economic incentives," is derived from the work of William Niskanen (1973). He maintains that non-profit bureaucracies consistently engage in "budget maximizing" activities such as creating a demand condition for a particular service. The immediate and wide-spread adoption of microcomputers illustrates this point. For despite the absence of research which shows the educational benefits of computers, school boards and community groups demanded that they be placed in the schools. Consequently, boards rushed to purchase them as soon as they appeared in the market place. Once computers were in the schools, the initial demand was satisfied. In communities in which the demand for computer <u>use</u> arose, boards soon realized that

implementation was costly, perhaps moreso than the initial adoption (Oettinger, 1969, p. 222). The new demand condition, implementation, then requires expenditures for inservice training, software purchase, computer furniture and security devices, and in some cases "economic" incentives for teachers. The economic incentives included in this research are:

1. Paying teachers to acquire training
2. Providing release time from teaching
3. Offering bonus salary incentives
4. Giving course credits which enable teachers to move to a new salary lane more quickly
5. Reimbursing teachers for committee time

The author contends that without the use of economic incentives, implementation efforts will not succeed.

Gordon Tullock (1969) recognized that individuals in a bureaucracy may have other needs besides money. He argued that political incentives, those rewards which increase the strength of one's position in the bureaucracy or offer potential for promotion, are the primary basis for individual decisions. When faced with alternative choices regarding a specific decision, Tullock (1969) claims that

one will select the one which makes the individual "look good" to his or her superiors, not that which may further the goals of the organization (p. 119). Applying this argument to the implementation of computers, because teachers are generally reluctant to implement technology (Leithwood and Montgomery, 1982, p.332-333), a principal would need to provide strong political incentives, not just "support," which would outweigh the resistance to innovation. The specific political incentives included in this study are:

1. Providing public recognition for individual staff members
2. Formally recognizing computer use in a memo to the central office or school board
3. Arranging for media coverage
4. Tying computer use to job security
5. Tying computer use to potential for promotion
6. Offering an enhance job title for successful computer use

The final variable, SES, was used because two studies have shown that it is strongly related to implementation while a third shows that the behavior of "effective"

principals differs in schools according to SES. In a nationwide study of computer implementation, Becker found that a relationship may exist between school SES (as measured by parental income) and the student:computer ratio (Becker, 1983, 3, p. 2). High SES, predominantly white elementary schools had a ratio of 155:1 while low SES, predominantly white schools had a ratio of 192:1 (Becker, 1985, p. 16). McGee (1985) found that high SES schools tended to have much stronger computer programs while the difference between those in low and average SES schools was insignificant. Specifically, he found that high SES schools had significantly higher scores on eight different measures of implementation than did either low or average SES schools. Whereas low and average SES schools had similar implementation scores, high SES schools were in a class by themselves. Moreover, the regression analysis he used demonstrated that SES was a causal variable. SES directly affected the scope of the elementary school's computer curriculum. Finally, Hallinger and Murphy (1985) found that the nature effective instructional leadership in high SES schools was different from that in low SES schools. The principals in the former did more coordination and "orchestration" while those in the latter combined coordination with more direct actions. Taken together,

these three studies imply that it is not just SES but the interaction between SES and the nature of the principal's actions which may lead to successful implementation of the microcomputer.

In this study, the author used the occupational scale employed by Lortie, Crow, and Prolman (1983) as a measure of SES. "High SES" schools (n=17) were those in which students' parents were executives, doctors, lawyers, or individuals who managed large businesses or farms. "Middle SES" schools (n=74) were those where parents were middle managers, small business owners, salesworkers, and the like. "Low SES" schools (n=19) were those in which parents were clerical employees, laborers, machine operators, tradesmen, or unskilled workers.

The dependent variable used in this study is computer "implementation" which is actually a composite of several different measures of implementation drawn from both theoretical and empirical sources. Gross et al (1971) and Fullan and Pomfret (1977) have argued that a major problem with studies of innovation is the lack of precise measures of implementation, and Fullan and Pomfret have listed criteria which such measures should meet. Becker's (1983) recent nationwide study of computer use has shown that some measures of implementation can be accurately assessed. By

using Fullan and Pomfret's guidelines, by working with administrators, teachers, and students as they use computers, and by reading Becker's work, the author was able to devise a means for measuring ten different aspects of implementation: the accessibility of the machines, the frequency of daily use, the trend in computer use, the percentage of students using the computer regularly, the range of academic ability of student users, the variety of modes for which the computer is used, the extent of programming instruction, the extent of CAI use, the teachers' level of computer literacy, and the staff's perception of the impact of the computer on the curriculum. These variables provide a thorough picture of the impact of the computer on the students, staff, and curriculum. The dependent variable, "implementation," is the mean of the ten scores of the individual variables.

Data Source and Collection

For this study the author used a large simple random sample of 160 elementary schools in the seven northeasternmost counties in Illinois. From phone calls to superintendents and principals, he found that twenty-six of these schools did not have computers and six principals did not wish to have their schools included in the study. The

final sample, then, consisted of 128 elementary schools. Of these, twenty-one were Kindergarten through eighth grade schools (K-8), sixty-five were K-6, fourteen were K-5, six were K-4, five were K-3, four were 4-8, four were 5-8, three were 6-8, two were 4-5, and there was one each of grades K-2, 3-4, 3-5, and 4-6.

Although his sample was selected from a particular region in a particular state, the findings will be important because that area contains a large portion of the state's population. Since the sample is not a nationwide simple random sample, however, the findings will not be useful for all elementary school administrators and teachers but may be cautiously generalized to other large metropolitan areas.

To measure the extent to which the independent variables influenced implementation, the author developed self-administered questionnaires for the principal, learning center (media center) director, and classroom teachers. These instruments were first used in a pilot study and then revised to meet stringent criteria for validity and reliability (McGee, 1985). Although the three questionnaires differed in content and length, each provided information concerning the degree of implementation and the use of support and incentives.

To guarantee a large response rate, the author used several means. First, before proceeding with the survey, he wrote the superintendent of each school district a letter which explained the project. Soon after they received the letter, he called them to obtain permission for the research. Second, once the superintendent granted permission, the author met briefly with each principal to explain the purpose of the study and the questionnaires. Third, having made initial contact, the author left the questionnaires and then returned to collect them three to six weeks later. Fourth, each respondent received an envelope marked CONFIDENTIAL for the completed questionnaire as well as a cover letter which assured the confidentiality of all responses. This provision for anonymity encouraged teachers and administrators to complete the questionnaires thoroughly and honestly. Finally, the questionnaires were easy to complete requiring the respondent to spend between ten minutes (teachers) and thirty minutes (principals) answering the questions.

These methods of data collection produced a high return rate. The author received 99.2% (127 of 128) principal's questionnaires, 100% (105 of 105) of the learning center director's, and 78.8% (1170 of 1484) teacher's surveys. For the final data analysis, however,

eighteen of the schools had to be dropped. Four were eliminated because the computers had been in the building only a few weeks and had not yet been used by students. Ten others had to be dropped because the author did not obtain a sufficient sample of teachers. Only a few of the teachers in each of these ten schools completed questionnaires, and they were all avid users and highly computer literate. Their responses were not representative of the staff and would have biased the implementation variables upward. Four other schools were dropped because no classroom teachers completed the questionnaires. In these schools the computer program was taught as a separate course by a special teacher much like physical education or music are taught in most elementary schools.

The final sample used for the data analysis contained responses from 110 schools. These included 100% of the principals and learning center directors and 84.5% of the teachers.

Having collected the data, the author developed a categorical ranking for SES and a scaled score for each of the other variables. Because all variables were assessed by responses to more than one question, the scoring method involved several steps. First, on every questionnaire the researcher converted the raw scores for each question to a

scaled score. Second, he averaged all of the scaled scores for a particular variable on each questionnaire. Third, after all questionnaires for a school were scored and uniformly scaled, the author averaged all of the teachers' questionnaires to obtain a composite teachers' score for each variable. Finally, the composite (mean) teachers' score for each variable was averaged with the learning center director's scaled score and the principal's scaled score to give one final scaled score for each variable. By using the average of the three categories of respondents' scaled scores, the author hoped to reduce the influence of systematic bias any one group might have toward over- or under-reporting measures of implementation.

Once scores were ascertained, the author used Pearson correlations to find significant associations between each of the "support" variables and implementation and an analysis of variance to see how the principal's use of incentives differed in schools of varying SES as well as to see how SES interacted with incentives to influence implementation. The results of the analysis are presented in the following section.

Findings

Table 1 shows the correlations between each of the scaled independent variables and total implementation.

Insert Table 1 about here

Table 1 shows that the principal who provides political incentives is more likely to have a successfully implemented computer program. This finding concurs with those of Leithwood and Montgomery (1982) who found that the lack of teacher motivation and absence of incentives were obstacles to successful innovation. In this study the author found that teachers were not just unmotivated but that they were often very skeptical of computer instruction. Moreover, both principals and learning center directors cited teacher resistance, apathy, fear, and anxiety as one of the greatest obstacles to implementation. By providing incentives, though, the principal could motivate teachers to overcome their resistance and even encourage teachers to promote an entirely new subject--programming.

A second important finding evident in Table 1 is the absence of any significant correlation between support and implementation for all of the SES subsamples. Apparently, moral support, encouragement, and personal, as opposed to public, recognition is not associated with implementation. Although the principal may be increasing the teacher's morale, providing such support does not further the process of implementation.

The most striking finding in Table 1, though, is the high positive correlation between political incentives and implementation in high SES schools in contrast to the weak correlation coefficients for low and average SES schools. In high SES schools, the principal's provision of political incentives is significantly associated with implementation. A possible explanation is that teachers in high SES schools need more political incentives from the principal to implement computers than their counterparts in low and average SES schools because the teachers in these latter schools have other reasons for using computers with students.

To determine the validity of this explanation, the author asked teachers to identify reasons why they used computers in classrooms and to star the single most important reason. Table 2 illustrates the results from this question.

Insert Table 2 about here

By far the most frequently cited reasons were "It's good for the students" (20.9%) and "Appreciation of students" (17.9%). Next most often cited were "It's fun" (14.5%) and "Personal rewards" (10.1%). The responses pertaining to political incentives were cited less than 7.5% and the ones concerning economic incentives were cited less than 5.1%. When all responses relating to incentives (a total of eight of the eighteen items) were added, they did total 21.1%. Teachers do cite incentives as a reason for implementation but more frequently cite student centered reasons as the most important ones. "It's good for the students" was starred as the most important reason by 52.6% of the

respondents, and "Appreciation of the students" was chosen by 16.9%. A total of 69.5% of the most important reasons for implementation were in consideration of students. The sum of all starred incentive items was only 7.4%.

An important finding concerning these responses is not shown in the table, however. There were no significant differences between the percentages reported among subsamples of teachers grouped by SES. Most teachers said the most important reasons for implementing computers were "it's good for the students" and "appreciation of the students." In low and average SES schools where students are less likely to have a computer in their homes, they may be more appreciative of the teachers' use of the computer, and the teacher may be providing the students with a new and novel experience. Because students in high SES schools are more likely to own a home computer, the opportunity to get one in the near future, or the chance to use a friend's, the teachers are not providing an experience they may not have received at home. Also, if the students have ready access to a computer outside of school, they may not be so appreciative of the teachers efforts to use the computer in the classroom. Consequently, teachers will need to have more inducement from the administration to provide implementation. In short, student rewards or incentives in

low and average SES schools may make the use of administrative incentives unnecessary.

Also, the correlation between political incentives and implementation may be higher in high SES schools because the student:computer ratio is lower (Becker, 1983; McGee, 1985). In schools with a small number of computers, most teachers may simply not have the time to use them. Often, their use is dominated by one or two teachers. Teachers reluctant to use the machines will not need incentives to use the computers because the machines are not available. Even those teachers who are enthusiastic or motivated will find access to the computers difficult; thus, implementation will proceed more slowly than in schools with a larger number of computers. In schools with more computers available (high SES schools) all teachers will have the opportunity to use the machines. Reluctant teachers will need to be motivated or forced to use the machines. In these schools, the principals need to provide incentives to encourage teachers to use the computer.

A third explanation for the high correlation between provision of political incentives and implementation in high SES schools is not evident until one examines one component of the implementation measure, programming instruction. The correlation for this variable is shown in Table 3.

Insert Table 3 about here

A reading of the Table 3 indicates that the provision of political and economic incentives is highly correlated with programming instruction in high SES schools. One explanation of this finding is that more programming instruction takes place in high SES schools and in order to convince teachers to master this new instructional skill and to allot time to it in an already busy day, principals must provide strong, important incentives. Whereas teachers do not need these incentives to teach computer literacy or to use computer assisted instruction (the correlations are weak and insignificant regardless of SES), programming instruction is a much more difficult and demanding task which involves more time commitment from the teacher.

To determine more precisely the relationship between SES and the nature of the principal's support, the author investigated how frequently principals in different schools used incentives and support. Table 4 shows the results of this analysis.

Insert Table 4 about here

Although principals provide approximately the same amount of economic incentives regardless of the SES of the schools, principals in high SES schools provide significantly more political incentives for encouraging computer implementation. In addition to points cited above, one reason for this finding is that "politics" may be more of a fact of life in these schools. Although no hard data supports this speculation, anyone who has taught in public schools knows the advantages of teaching in high SES schools. Teachers seem to have fewer academic and discipline problems to manage and more parental support. Keeping a job in a high SES school becomes an important consideration and teachers will naturally find opportunities to strengthen the security of their position. Using computers may be one way to accomplish this goal.

Another reason may be that principals may have more time available for providing public recognition. Applying a similar argument that principals in high SES schools also

have fewer problems with students and parents, one could assume that they would have more time available to devote to other matters such as providing political recognition. Arranging publicity for teachers, writing formal notes to the superintendent, and publicly recognizing the accomplishments of teachers takes time, time which may be more readily available to principals in high SES schools.

A reading of Table 4 shows that principals do not differ significantly in their use of support, but that principals in low SES schools provide more than those in average and high SES schools. The absence of significance between low SES and average or high SES schools is due to the large standard deviations. These indicate that in all types of schools, the support principals provide varies greatly and that little central tendency exists in any of the SES subsamples. Apparently some principals believe in its effectiveness and use it frequently while others either do not take the time to provide supportive encouragement or do not use it because they have found it ineffective in promoting implementation. Whatever the reason, the variance is much larger than for the use of economic or political incentives. The higher mean score of principals in low SES schools indicates that these individuals may tend to rely on the use of support more than their counterparts. As

mentioned above, teaching in low SES schools may not be as appealing as teaching in high SES schools and consequently principals may be inclined to offer the staff more regular encouragement or support.

The data in Table 4 indicates that SES may interact with the use political incentives to influence the implementation of the computer. To determine the validity of this contention, the author used quartile scores to categorize each of the independent variables into low, average, or high. For example, low support scores were all those in the bottom quartile of support scores, high were those in the top quartile, and average were those in the middle two quartiles. Once the scaled scores were categorized, he used an interaction analysis (Tukey test) to find if any of these three independent variables interacted with SES to influence implementation.

The interaction between provision of economic incentives and SES was significant ($p < .001$), but the interaction between the provision of political incentives and SES was not, though it was close ($p = .060$). The interaction between the provision of support and SES was also not significant ($p = .613$). The graph of the mean scores (figure 1) for the interaction of SES and provision of economic incentives shows on one hand that principals in

low and average SES schools have nearly the same levels of implementation no matter how many incentives they use. On the other hand, it shows that in high SES schools where principals use more than minimal (low) incentives implementation soars. Figure 2 indicates that the same finding holds true with political incentives. In high SES schools a threshold level of incentive provision apparently exists.

Insert Figure 1 about here

Insert Figure 2 about here

These findings support the earlier statement that high SES schools are in a class by themselves. The use of economic incentives to influence the implementation of computers appears to be effective in high SES schools alone. This finding may be explained by the demands of the community for implementation. In low and average SES communities, parents and board members may want computers in the schools, but in high SES communities they want the computers used. According to Niskanen, this new "demand condition" will insure that more money is available to support implementation. Assuming that some of these funds are used to provide economic incentives to teachers, one can see why the mean implementation scores are significantly higher in high SES schools which have principals who provide economic incentives.

While the use of political incentives is correlated with implementation, these are also used more frequently and more effectively in high SES schools. The environment of the high SES school appears to be more conducive to the successful use of incentives. As noted above, this finding may be explained by the absence of student and parental problems, the desire for teachers to maintain their job security, the time the principal has available to provide incentives, or the availability of computers in homes.

Three other plausible explanations exist for the interaction between SES and provision of incentives on implementation of the microcomputer. First, teachers in high SES schools may be more reluctant to implement the new technology. They may have no desire to add a new element to the curriculum which is already too filled with other subjects or may not see how computer instruction can benefit their students.

Second, since high SES schools generally have higher levels of computer implementation, it may be the use of incentives which takes the high SES schools above the threshold level of implementation found in low and average SES schools. The fact that political incentives are used more frequently in high SES schools and that their use is correlated with implementation implies that part of the reason for higher implementation scores is this more frequent use.

A final speculation is that on one hand, the administration in high SES schools may not require teachers to implement computers but rather encourage it through the use of incentives. On the other hand, in low and average SES schools, they may use more directives or rely on formal policy to require teachers to implement computers. Although the author did not collect data in this study to support

these three claims, his experiences in schools and his conversations with teachers in some of the richest and poorest schools in Illinois indicate that these contentions are worthy of further study.

Also, further research into the principals' use of incentives is necessary to determine its causal effects and its interaction with SES. The findings in the previous section indicate that principals in high SES schools use political incentives significantly more than their peers in low and average SES schools. Though both the use of incentives and SES are independently related to implementation, it is inconclusive whether the interaction of SES and the use of incentives influences implementation. Further study with a larger sample of high and low SES schools as well as a regression analysis would clarify the impact that incentives and their interaction with SES have on the implementation of technology.

Conclusions

In this paper the author examined the impact of principals' use of support, economic, and political incentives on the implementation of microcomputers. One major finding was that the successful implementation of the computer was not a function of principals' abilities to

establish economic incentives for themselves or for staff members to reward the extended time and effort necessary for implementation.

Providing economic incentives is not significantly correlated with technological implementation though its use in high SES schools does have an impact on implementation. One explanation for the ineffectiveness of economic incentives is that schools typically do not have the funds to provide such incentives. The most commonly cited obstacle to implementation was lack of funds to purchase hardware and software. Since money is frequently not available for capital outlay, it may not be available for incentives. School boards, then, appear to be content to use funds primarily for acquisition, not implementation. As Niskanen (1974) recognized, until a new "demand condition" exists, that is, the demand for implementation, the board may not see fit to appropriate additional funds.

Two individual cases support this explanation. In one instance, the election of three new board members immediately changed the administrative support for the district's computer program. Though a substantial investment had been made two years earlier, the board decided to cease all further expenditures for computer education until their benefits were shown by improved test

scores. These schools all ranked in the lowest half of total implementation. In the second instance, in schools which have the greatest community demand for use, high SES schools, economic incentives influence total implementation. Teachers in these schools are frequently paid for the training they receive, compensated for committee work, given adequate release time, and the like. Since most schools do not have this same demand for computer use, economic incentives are not provided.

A second explanation for the ineffectiveness of economic incentives independent of SES is that teachers may not expect to receive them. Yearly raises are usually obtained through lengthy negotiation, and financial "rewards" are salary increases based on the teacher's length of service, amount of formal education, and his or her willingness to sponsor an activity such as student council, coach a sport, or take on a similar extra duty. Receiving a bonus for teaching a new skill during the school day is unthinkable to most educators. In fact, in many school districts teachers are not fully reimbursed for attending college classes or workshops in order to learn a new skill which they have been asked to teach. As noted above, most teachers did not mention financial incentives as a reason for implementation and when asked to indicate the one most

important reason for implementing computers, only 0.3% responded "financial rewards." Motivation and commitment to implementation cannot be bought. The findings of the Rand study parallel the findings of this study as they reveal the futility of enticing commitment:

> Teachers typically elect to spend the time and energy necessary to carry out a new practice primarily out of professional concerns--because they believe these efforts will help them become better teachers. Extrinsic rewards such as pay for training cannot stimulate the commitment of teachers if they do not see it to be in their professional self-interest.(Berman et al. 1978, p. 27)

The economic incentive theory which applies to other bureaucracies may not apply to public schools. Limited resources and lack of staff members' expectations of rewards characterize schools as a unique public institution.

A second major finding was that the successful implementation of technological innovations is a function of the principal's ability to achieve recognition or "political" rewards from the school board, superintendent, or community for his or her own and staff's efforts to

implement the innovation. Principals who provide political incentives are more likely to have more highly implemented computer curriculums. Political incentives may include recognition from the principal, community and peers, more influence in the school, recognition in the local press, and increased professional status. These incentives may not seem particularly important to anyone not in education, but given the nature of the school they are important to teachers. Since financial incentives or rewards for implementing innovations are very limited, if they exist at all, teachers expect and generally appreciate other rewards. Recognition is an important symbol which is rarely provided, but which has a strong impact when offered by a principal, parents, or the central office.

Moreover, computer instruction and programming represent two brand new subject areas for which most teachers have not been adequately trained. Major universities have yet to incorporate microcomputer instruction into teacher training curriculums and teachers who have learned its use have had to do so on their own time. A principal, then, who wants a teacher to learn a new skill and then teach it must be prepared to provide incentives or to release the teacher from an existing duty. Such incentives include recognition in the press, formal

notes or memos, "perks" such as a long lunch period or go home early day, and the like. A release from duties may include removing the teacher from a coaching or activity supervisory position, using an aide or substitute to teach a period, or permitting attendance at workshops during school hours. Principals who provide incentives have teachers who provide more frequent computer use and more programming instruction, and who perceive their school's program as more completely implemented than teachers whose principals neglect to provide these incentives.

A third major finding is that both economic and political incentives appear to be especially important in implementing programming instruction, especially in high SES schools. There the principal's provision of economic incentives correlates + 0.63 with the extent of programming instructions and the use of political incentives correlates + 0.60. If a principal expects teachers to incorporate a new subject into the curriculum, he or she must be willing to provide incentives for their efforts. From reading this study one can conclude that the principal's decision to provide incentives will contribute to implementation. Teachers respond to financial inducements or recognition, for in schools in which they receive them, the computer curriculm is strong.

A fourth major finding was that the principal's use of moral support and encouragement is not related to implementation of the technological innovation for any SES subsample. A kind word, a pat on the back, an informal note, and other methods of support are not sufficient inducements for teachers to implement new technology in their classroom. Teachers need to know that the innovation is beneficial to students and that students appreciate their efforts. They also need more than support from the administration. Studies which claim that the principal's support or endorsement was crucial to successful implementation of an innovation are misleading for support alone, without the use of political incentives will have no effect on implementation. Further research into the nature of support and the use of incentives is needed to identify more precisely the effectiveness of specific incentives as well as other means a principal could use to influence implementation.

The final major finding is that the principal's use of incentives interacts with SES in influencing implementation. Several explanations for this finding were advanced in the previous section, including the teaching environment of the high SES school, the motivation of teachers for securing their position in the school, the availability of time for

the principal to provide incentives, the number of families having computers in the home, the stronger resistance teachers in high SES schools may have to computer use, the existence of a threshold level of implementation, and the use or absence of administrative directives. Unfortunately, data was not collected to support any of these tentative conclusions.

Hallinger and Murphy (1985) have shown, however, that the work of "effective" principals in "effective schools" varies according to the SES of the school. Their research coupled with the above findings that (1) computer implementation in high SES schools is higher than that in low and average SES schools, (2) the use of political incentives is correlated with implementation, (3) the use of political incentives is more prevalent in high SES schools, and (4) the use of economic and political incentives appears to interact with SES in affecting the degree of computer implementation, show that the relationship between the role of the principal and school SES is a fruitful area for further inquiry. Methods leading to successful implementation in high SES schools differ from those used in low and average SES schools. One can only conclude, then, that future research concerning implementation can no longer ignore the social context in which it occurs.

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Table 1

Correlation Coefficients for Total Implementation Meausre by SES Subsamples

		SES Subsamples		
Independent Variables	Total Sample	low	average	high
Econ. Incent.	.12	-.09	.03	.47
Polit. Incent.	.40***	.19	.22	.71***
Support	-.06	.06	-.08	-.14

* p < .05 ** p < .01 *** p < .001

Table 2

Reasons Teachers Cite for Implementing Computers

Reason	Percentage citing reason as one for implementation (n = 6255)	Percentage citing reason as the "most important" (n =1075)
1. Financial rewards	0.3	0.3
2. Recognition from principal	3.5	1.4
3. Recognition from my peers	2.4	0.5
4. Appreciation of parents	7.5	0.4
5. Improved professional status	3.9	3.0
6. Increased job security	2.0	1.5
7. Improved promotional opportunity	0.5	0.0
8. More influence in school	1.1	0.2
9. Appreciation of students	17.7	16.9
10. Personal rewards	10.1	4.3
11. It's a job requirement	5.3	7.1
12. It's good for the students	20.4	52.6
13. Loyalty to the principal	1.5	0.6
14. Peer pressure	1.1	0.7
15. Parental pressure	2.4	0.9
16. It's fun	14.5	7.4
17. It makes my job easier	4.9	1.5
18. Other	1.0	0.6

Table 3

Correlation Coefficients for Programming Implementation Measure by SES Subsamples

Independent Variables	Total Sample	SES Subsamples low	average	high
Econ. Incent.	.25**	.42	.08	.63**
Polit. Incent.	.21*	.31	.24*	.60*

* $p < .05$ ** $p < .01$ *** $p < .001$

Table 4

Mean Scores for Independent Variables
According to School Socio-economic Status

Variable	Means by SES						
	Low (n=19)		Average (n=74)		High (n=17)		Significantly
	Mean	SD	Mean	SD	Mean	SD	Different Pairs
Econ. Incent.	24.9	10.9	22.8	11.7	27.5	9.2	none
Polit. Incent.	38.5	11.9	37.7	13.0	51.2	13.9	high/avg ** high/low **
Support	46.7	36.7	35.7	28.4	38.3	29.3	none

** $p < .01$

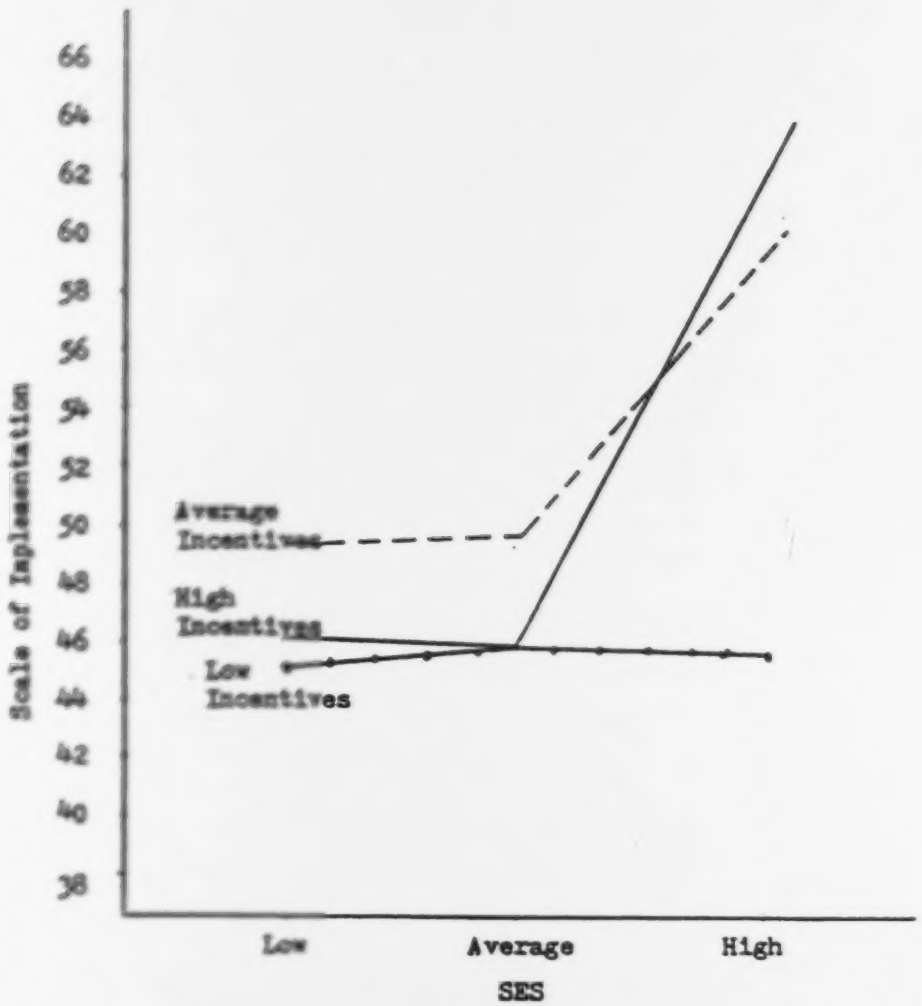

Figure 1. SES by Provision of Economic Incentives: Implementation

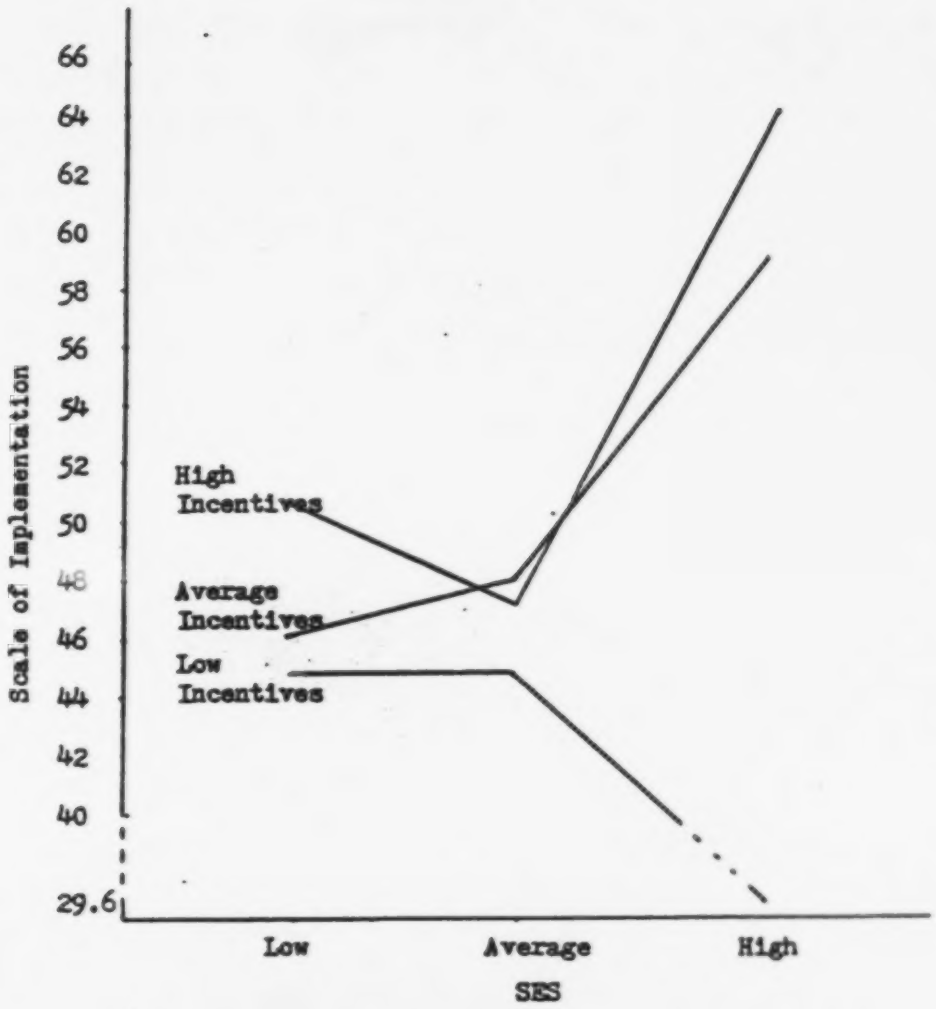

Figure 2. SES by Provision of Political Incentives: Implementation